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COMMUNICATIONS

THE RETINAL PULSE

BY

R. H. ELLIOT, Lt.-Col. I.M.S. (Retd.)

LONDON

IT is extraordinary how little is known on the subject of the retinal pulse. The textbook statements on the subject are meagre, and much that has been written is inaccurate. Bailliart's writings have recently stimulated an interest in the subject, especially in France. Under the spell of this work, the writer has recently endeavoured to study the subject more closely than he had done before, and to strive to obtain some accurate and reliable information on points which have hitherto been nebulous and vague.

The Arterial Pulse

There would appear to be not a few ophthalmologists who have never observed this pulse, and yet, as a phenomenon it is so striking and characteristic that no surgeon who has once seen it can ever mistake it afterwards. When dealing with the venous pulse, all gradations are seen between a well-marked beat on the one hand and an almost imperceptible flicker on the other. Indeed, it might well happen in the latter category that several men examining the same case would differ in their opinions as to whether pulsation were present or absent. This would be impossible with the arterial pulse: it flashes out over the whole breadth of the disc, affecting every branch of the artery thereon and even beyond it. It is, however, best seen on the disc itself, for "in the retinal part of the optic nerve, the vessels lie wholly superficial; i.e., they are n

covered by nerve fibres" ("Anatomy and Histology of the Human Eye," Salzmann, Chicago, 1912, p. 89). The pulse is so instantaneous as to suggest the quick flash of a lighthouse stabbing the darkness of night, and passing away as quickly as it came. It has, therefore, nothing in common with the localized, gradual, slowly-developing and slowly-passing venous pulse.

It is seen whenever the intraocular pressure passes the pressure in the arteries during the period of diastole, but is lower than the latter during the systolic period. As Bailliart has so pertinently pointed out, it is an indication that the circulation through the eye is being maintained only during a part of the cardiac cycle. It has therefore very little in common with the ordinary arterial pulse, which is a physiological phenomenon, while this is pathological. Bailliart has observed that, if we use a magnifying ophthalmoscope, such as Gullstrand's, we can see the physiological pulse in the retinal arteries under normal conditions. This is on all fours with the observation that, by the use of suitable apparatus, we can detect the pulse even in the digital arteries; indeed, with care, and granted a delicate sense of touch, we can do this in many patients, without the aid of any form of apparatus. We should not, however, think of confusing this faint digital pulsation with the pulse of aortic insufficiency, which arises as the result of changed pressure conditions within the vessels. In the same way, it would not be reasonable to confuse the normal retinal pulse, as seen under magnification with the ophthalmoscope, with the flash pulse, which we commonly speak of as "the diastolic pulse." Bailliart thinks it is better to reserve the term retinal pulse for the appearance of this phenomenon under abnormal conditions, and probably most of those who have studied the subject will, for convenience sake, agree with him in this.

The diastolic pulse can be very easily seen in most normal eyes: Get the patient in a comfortable, easily reachable position, and examine the fundus with an electric ophthalmoscope by the direct method; while doing so, press with the tip of the index finger on the outer commissure of the eyelids, beginning quite gently, and gradually increasing the force used; as this is done, the pulse will suddenly flash into sight, and will continue so long as the pressure is continued. It is of interest to note that at the lower level of pressure, when the intraocular pressure just exceeds the diastolic arterial pressure, the period during which the artery is emptied is very short as compared with that during which it is filled. As the pressure is increased and the systolic level is approached the filled phase of the artery gets shorter and shorter and the empty phase correspondingly longer. Bailliart and others advise the continuance of this pressure until the pulse disappears, at the point when the intraocular pressure has been raised above the level of the maximum,

or systolic, pressure in the retinal artery. However interesting this may be from the point of view of the examiner, it must be borne in mind that it is a proceeding, which, at least under morbid conditions, may not be wholly free from risk. That this is true, is evident from the fact that on two occasions Bailliart has observed the onset of syncope in the course of the routine performance of this manoeuvre. It may be countered that the darkness which precedes syncope, whether from haemorrhage or otherwise, and which has been noticed in those in the algid stage of cholera and in the dying, is practically of the same nature, and yet that in the syncopic cases, and possibly in the choleraic ones, there is no evidence of any permanent damage being done. To this we may reply that it is not easy to be satisfied that no harm is done to the sight in syncopic cases, especially when due to haemorrhage; nor could we unreservedly subscribe to a similar contention in the case of cholera. The question raised is a thorny and difficult one, but certain important points may here be mentioned: (1) When pressure is being applied to the eye we are ***provoking a rise*** in pressure in the venous channels at their exit, and back through the capillaries to the arterioles. Is it quite safe in the elderly to risk the possibility of a haemorrhage in this way? The condition in syncope is quite different, for there the pressure ***falls*** throughout the vascular system of the eye. (2) The surgeon, as distinguished from the physiologist, has much to learn from the amount of pressure, which will induce the appearance of the diastolic pulse; has he an equal amount to gain from the abolition of the pulse at the point where systolic pressure is reached and passed? If not, the possible increase of dangers, as the higher level is approached, would make it advisable to exercise caution. Be it understood that these questions are merely meant to be suggestive, and that the writer makes no attempt to answer them, because he feels that at present it would be difficult to do so. His desire is that those who employ these interesting and fascinating methods of study, should do so with their eyes open.

The Venous Pulse

This differs widely, and in many respects, from the arterial pulse: (1) It may be so well marked that a student would easily recognize it, or so feeble as to require the closest scrutiny for its detection; indeed, in some cases, the only available evidence is a rhythmic change in the depth of colour at a point where a vein makes a sharp bend on its course, no actual movement being detectable; any intermediate condition may be found between the two extremes above described. (2) It is best seen where a vein is either passing into the structures of the optic disc, or is making a sharp bend during its course. It may sometimes be observed on one or other side of

an artery which crosses the vessel, a matter to which we shall return later. (3) It may effect only one branch of the central retinal vein, or may be seen in a number of branches. It is probable that anatomical considerations have much to do with this peculiarity. (4) If very carefully studied in chosen cases, the pulse will be seen to resolve itself into a double movement: (I) An alternating increase and decrease in the breadth of the vein, and in the depth of colour of the blood column within it, and (II) a slow, emptying and refilling of a segment of the vessel—the changes in colour run along its length, away from the heart, as the vessel empties, and back toward it, as it refills. This movement can be particularly well studied in cases in which gentle pressure increases the venous pulse; as the force applied is increased, the length of vein affected is seen to increase with it, until quite half or even the whole of the part on the disc may be involved. One can never detect it beyond the papillary limit; this may be accounted for in three ways: (*a*) The vessels and their movements show up best on the optic disc; (*b*) in the retina they are embedded in the structures of that coat, whilst on the disc they lie comparatively unhampered (Bailliart); (*c*) the pulse has probably spent itself within the limits of the disc. Another impression may be given of the appearances presented by this phenomenon: The vein first seems to flatten to some extent along an appreciable length of its course, and then to empty itself along a part of this length. The emptying seems indeed to be merely an exaggeration of the flattening, and to affect the part where the pressure is lowest, travelling all the while in the direction of the higher pressure. (5) In a number of eyes the venous pulse is comparatively short. This is presumably due to the venous pressure being here relatively so high that the flow in the vessels is only interrupted during the height of systole, and even then only for a brief period. If, however, a gradually increasing pressure is exerted on the eye from without, the pulse, at first, often becomes more and more marked. The principal point that one then notices is that the duration of the phase of emptiness of the vein is markedly lengthened. This is obviously due to the ocular pressure having been so far raised by the pressure applied, that it is above the venous level for a comparatively long period during each cardiac cycle. The onflow of venous blood, at least in full current, then only takes place during the comparatively short period, when the venous pressure is at its highest, simultaneously with the arterial being at its lowest. (6) When, under pressure on the eyeball, a diastolic arterial pulse is produced side by side with a venous pulse, it will be noticed that these alternate; the vein fills as the artery empties, and *vice versa*. We shall return to this subject later. For the moment we may content ourselves with saying that this phenomenon is best observed in those eyes in which under digital

pressure a pulsating vein and artery run parallel with each other for some distance, immediately before their disappearance into the substance of the nerve head.

The anatomical and physiological factors in the causation of the pulse in the retinal arteries and veins

Much of the confusion that has clouded our understanding of this subject in the past has been due to the want of a careful study of the various factors concerned in the production of the pulse in the arteries and veins, and especially of the time-factors.

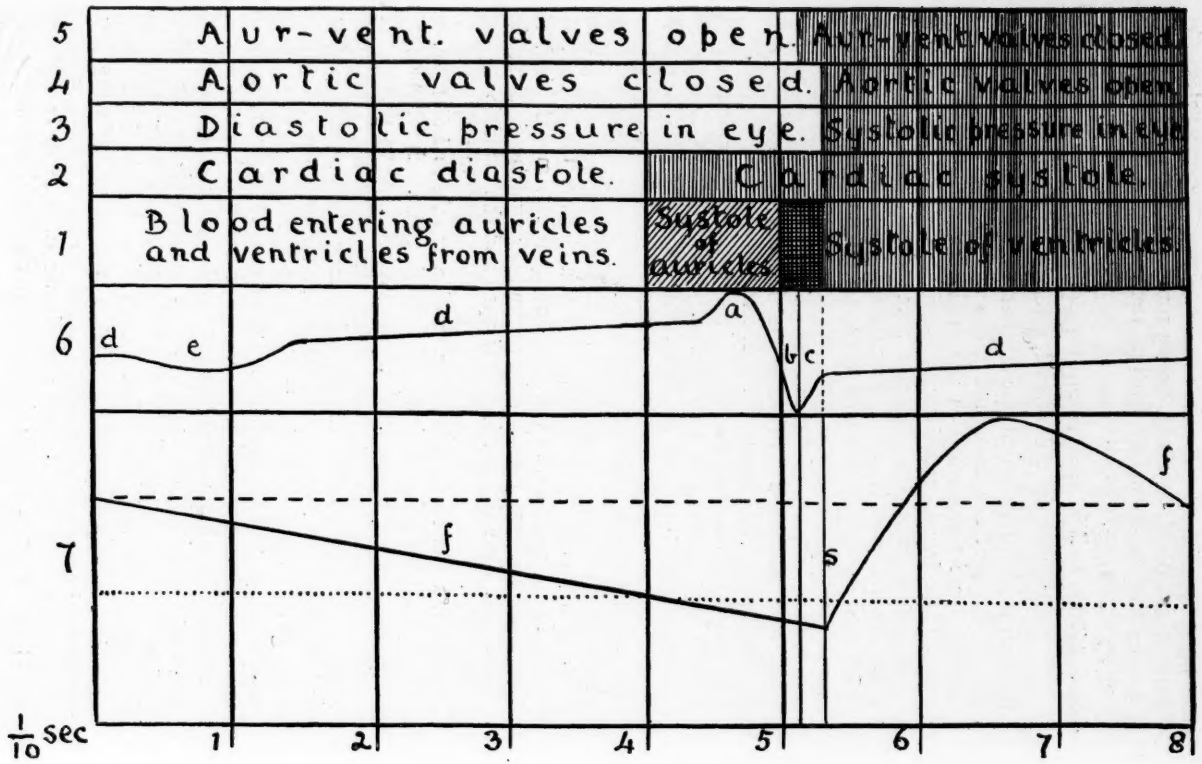
It is hoped that the diagram here given will materially help the student to arrive at a clear comprehension of the subject. It may look complicated, but a very short study of it will, it is hoped, prove that it is not so, and will serve to straighten out the tangle existing in many of our minds. The data have been mainly derived from Starling's "Principles of Human Physiology," and from Mackenzie's "Diseases of the Heart."

The vertical lines show tenths of a second, and the whole period of a heart beat is taken at 8/10ths sec. The columns should be read horizontally from left to right, starting with No. 1, which deals with the successive events that occur during a cardiac cycle.

No. 1. Here we have in turn the entry of blood into the auricles and ventricles from the veins for 0.4 sec., followed by the auricular systole, 0.1 sec., and that again by the ventricular systole 0.3 sec. During a fraction (shown in the diagram by the cross-hatching) of the first tenth of these 3 tenths of a second, the ventricle is closed in all directions, then the aortic valves open and the blood leaps out into the aorta.

No 2 shows the contrast between cardiac systole and diastole, as looked at from the point of view of the physiologist. It will be seen that the heart is at rest (in diastole) for 0.4 sec., and in systole for a similar period. This is, however, a very different thing from systole and diastole, as ophthalmologists look at the matter, when they talk about the systolic and diastolic pressures present within the eye during the course of a cardiac cycle. A confusion of these two different uses of the same terms does much to prevent us from obtaining a clear conception of many of the problems involved. We can see this when we pass on to consider the next column.

No. 3 confines itself to a consideration of the variations in intra-ocular pressure, so far as they are produced, or influenced by the pulse-beat in the retinal arteries. Each time that the heart beats it pumps an additional quantity of blood into the retinal artery and its branches; the beat is an expression of the fact that the arteries become fuller for a brief period and then return to their previous calibre; the entry of an additional quantity of fluid into the eye—be the source of that fluid what it may—will have the effect of


5
Aur-vent. valves open.
Aur-vent. valves closed.
4
Aortic valves closed.
Aortic valves open.
3
Diastolic pressure in eye.
Systolic pressure in eye.
2
Cardiac diastole.
Cardiac systole.
1
Blood entering auricles and ventricles from veins.
Systole of auricles
Systole of ventricles.
6
d
e
d
a
b
c
d
7
f
s
f
1/10 sec
1
2
3
4
5
6
7
8

raising the intraocular pressure in a measure proportional to the volume of the fluid so added; similarly the escape of a quantity of fluid from the eye—whether by the veins, as in the case we are considering, or in any other way—will effect a corresponding reduction in the intraocular pressure. This is the true story of the variations in intraocular pressure, which are brought about by changes in the blood-pressure conditions within the eye. Admittedly, it is not the whole story, but with that we are not concerned at present. On the other hand, to envisage intraocular pressure as being determined and ruled by intraocular blood pressure, is, save with very important reservations, unsound in theory and contrary to the findings of research. With these remarks in mind, let us turn again to column 3, and note that the increase of intraocular pressure, due to ventricular systole, only prevails for about 0.26 sec. The exact fraction of a second lost, owing to the time it takes ventricular pressure to force the barrier of the aortic valves and to commence to distend the systemic arteries, is differently stated by different authorities. It is not important; what is important is that we should note that the reign of systolic pressure within the eye, is over in about 0.26 sec., as compared with the period of 0.4 sec., when systole is considered from the point of view of the contraction of the heart as a whole. The importance of this observation will be clear later on.

We can now pass on to mark in columns 4 and 5 the points in the time-schedule of the cardiac cycle, at which the aortic, and auriculo-ventricular valves close, and open, for the important events which are thus signified have an obvious bearing on our subject.

No. 4. The first feature of interest is emphasized in this column, and is one to which we have already drawn attention in connection with No. 1, namely, the delay in the opening of the aortic valves, after the commencement of ventricular systole, and the consequent shortening of the systolic period in the arteries. We shall advert to this again in connection with a leading feature shown in column 7.

No. 5. The point of outstanding interest here is the delay in the closure of the auriculo-ventricular valves after the commencement of ventricular systole. The period of delay is, for obvious reasons, not so great as that which precedes the opening of the aortic valves, but it is none the less an appreciable one.

No. 6 crystallizes in a practical form the lessons we have learned in the previous columns. It shows the varying pressures within the auricles during the cardiac cycle, with special reference to the events on the right side of the heart. It may be taken to be approximately representative of what is happening throughout the systemic veins, since presumably, every change in the auricular pressure will influence the column of blood right away back to the capillaries. The sharp contraction of the right auricle causes a steep

rise (a) in the auricular pressure, and at the same time checks the onward rush of blood from the veins, and, since no valves are found at the orifices where the great veins debouch into the auricles, some reflux of blood must occur, even though this is limited, by the contraction of the muscular rings round the veins, which accompanies auricular systole. Clear evidence of this reflux wave is to be found in venous pulse tracings from the jugular vein, and indeed, there is reason to believe that it is transmitted right back to the retinal veins, and that it there forms a factor in the production of the venous pulse. The sharp closure of the tricuspid valve causes a steep, if limited, rise in auricular pressure (*c*) immediately following the very sharp fall (*b*) which is due to the relaxation of the auricles, and which follows their contraction. Then a steady rise (*d*) takes place in auricular pressure, as the auricle fills with blood; this rise is momentarily checked (*e*) by the opening of the auriculo-ventricular valves, and the consequent rush of fluid into the now dilating ventricle; and so we come back to auricular systole with its sudden, sharp exacerbation (*a*) of the hitherto steady rise in pressure. It is usually accepted that every feature of these changes is transmitted from the auricles right along the columns of venous blood behind them. Thus we see that venous pressure is at its lowest during the systole of the ventricles, and that a steady rise takes place up to the ventricular presystolic moment of auricular systole.

No. 7 must now be considered. It shows, primarily, the variations in pressure level within the retinal arteries, and secondarily the influence of those variations on the intraocular pressure. Like the previous column it is merely diagrammatic, but it presents in graphic form certain large features of the prevailing conditions. It will be noticed that during cardiac diastole, auricular systole and the presphygmic period (that which precedes the opening of the aortic valves), the arterial pressure within the eye is steadily falling. Coincident with, and consequent upon that fall, there is a corresponding, steady, though slight, decline (*f*) in intraocular pressure. The moment the aortic valve opens, and the sphygmic period begins, there is a sudden rise (*s*) in the arterial pressure within the eye. The slight delay in the arrival of the pulse at the periphery may be for the moment left out of account. In consequence of the volume of blood thrown into the eye by this pulse, a slight, but perceptible rise of intraocular pressure takes place, only to pass away again during diastole, as the arteries once again empty themselves. We have thus alternating phases of low and high pressure introduced into the eye as a result of the pulse in the arteries. Be it clearly understood that neither the arterial pressure, nor the variations in it, are to be held solely responsible for the maintenance of the level of intraocular pressure. Our point is that the arteries introduce a pulse into that pressure level,

and that the timing of that pulse can be clearly seen in the diagram.

A comparative study of columns 6 and 7 has several lessons to teach. Before attempting to learn them, it is essential that we should remember that the variations in intraocular pressure introduced by the beat of the arterial pulse, and those in the venous pressure, whose causation we have already discussed, are merely factors superadded to the main problem of the maintenance of a comparatively steady intraocular pressure. The latter is established at a mean level by the amount of total fluid within the eye (both aqueous and vascular) and depends upon the rates of secretion and excretion within the eye, and upon the nervous control of the great choroidal reservoir of blood. For the moment we are not concerned with this main factor of the problem. Our interest lies with the cycle of changes met with as a result of periodic variations in the arterial and venous circulation of the retina. Having thus cleared the ground, we may return to consider these two columns.

(1) *The cause of the venous pulse* is diagrammatically demonstrated to us, for we notice that when the venous pressure level is lowest, the arterial is highest and *vice versa*. Thus we have coincidentally a maximum of pressure on the outside of the veins with a minimum of pressure within them in the seventh tenth of a second; whilst, on the other hand, in the fifth tenth of a second we have a maximum pressure within the veins, and a minimum pressure on their surface. These rapid alternations of pressure conditions at once explain the existence of a venous pulse.

(2) *The varying characters of the venous pulse* are likewise explained: When the pressure within the vein only exceeds that outside for the period of the sharp systole of the auricle, we find during the fifth tenth of a second, that brief flickering pulse, which shows itself only as a change in colour at the point where a vessel takes its bend. The long, slow, venous pulse, which we see in other cases, finds its explanation in the steady fall of the arterial pressure and in the steady rise of the venous pressure, culminating in a reversal of these conditions in the sixth tenth of a second. When the period, during which the pressure *within* the vein is above that *outside*, is a long one, the pulse is slow, and the area of vein affected is extensive; when this period shortens, the duration of the venous pulse and the extent of vein involved likewise diminish. The whole sequence of events can be grasped by a study of these two columns.

(3) *The appearance of the diastolic pulse and its variations under varying conditions of pressure* can be studied from column 7 alone. In order to present the matter as graphically as possible it may be permissible to carry the diagram a stage further, always with

the proviso that the demonstration is diagrammatic, and that mathematical accuracy is not in any way claimed: (*a*) Imagine that the base line which marks the seconds represents the normal level of intraocular pressure; (*b*) That the dotted line represents an increase in intraocular pressure (digital or otherwise) just sufficient to produce a distinct diastolic pulse; and (*c*) that the broken line represents the level of pressure at which the systolic pulse is all but extinguished. It will be clear that when the pressure reaches the second of these two levels, the pulse produced will be a very short one; it will represent a very brief interruption in the even flow of blood through the arteries, at the period when the intraocular arterial pressure is at its lowest, and, as shown in the diagram, it will be met with during the fifth tenth of a second, and in a fraction of the following tenth. The result will be that the diastolic pulse produced will have the quick stabbing appearance with which all who practise digital pressure for the purpose are familiar. Such a pulse may take only a fifth of the cardiac cycle, or even less, for its manifestation, that is a period of rather less than 1/6th of a second. When, however, the pressure reaches the third level, the conditions are reversed, for now the period, during which blood is passing, will only be during the seventh and eighth tenths of a second; during the whole of the rest of the period, the flow will be arrested. Once again, the pulse will be a very brief one, but this time the short period will be that when the artery flushes red with blood, and the long one that in which it blanches. At any period intermediate between these two, an intermediate condition of the pulse will be encountered, so that if the pressure is suitably graduated, each pulse period may be made equal to the other, or the one can be increased at the expense of the other. With these considerations before us, we are able to appreciate the phenomena seen as we increase or decrease digital pressure on the eye.

The Relative Frequency of Occurrence of the Venous Pulse

This was studied by Bailliart in a series of 66 cases. The writer has examined a hundred consecutive patients, and has somewhat extended the observations made by the French scientist. The conditions found fall naturally into a number of classes: (1) Those in which a spontaneous pulse is present; (2) those in which no spontaneous pulse can be detected, but one appears under the influence of pressure on the eye; (3) those in which no pulse is detected either with or without the influence of pressure.

STATISTICS DERIVED FROM THE EXAMINATION OF 200 EYES.

A careful ophthalmoscopic examination was made of the fundus of both eyes in 100 consecutive subjects, in whom no disease was

present. The great majority of them consulted the writer for errors of refraction. Any patients with definite signs of disease were excluded; so also were those who were intractable or nervous, and those, who by reason of high errors of refraction or from any other cause, did not lend themselves to accurate observation.

(1) We shall deal first with the 100 patients considered as such:

(a) A spontaneous pulse was present in both eyes in 46 per cent.
(b) Do. do. absent in both eyes in 40 per cent.
(c) Do. do. present in one eye only in 14 per cent.

Total 100 per cent.

These figures require a little further consideration:

(a) Of these 46 per cent.—
The pulse was even in both eyes ... ... in 28 per cent.
Do. uneven in the two eyes ... ... in 18 per cent.

Total 46 per cent.

(b) Of these 40 per cent. in which a spontaneous pulse was absent—
A pulse was elicited by pressure in both eyes ... in 12 per cent.
Both eyes showed no pulse even on pressure ... in 20 per cent.
Pressure elicited a pulse in one eye only ... in 18 per cent.

Total 50 per cent.

(2) We shall now deal with the 200 eyes themselves regardless of the patients they belong to:

(a) A spontaneous pulse was present in 49 per cent.
(b) Do. do. absent in 51 per cent.

Total 100 per cent.

This classification is capable of a further subdivision in accordance with the different effects of pressure applied to the eye on the pulsation.

(a) Of the 49 per cent. of cases which fall under this heading—
Pressure increased the pulse in 35.5 per cent.
„ stopped or diminished the pulse in 7.0 per cent.
„ had no influence on the pulse in 2.0 per cent.
This point escaped notice in 4.5 per cent.

Total 49 per cent.

The above observations are based on the application of light pressure only. The cases which evaded full observation were among the early ones of the series.

(b) The 51 per cent. of cases in which a spontaneous pulse was absent, are capable of a further subdivision into two equal groups in accordance with the influence of pressure, since when this was applied—

a pulse was elicited in ... ... 25.5 per cent.
and none was elicited in ... ... 25.5 per cent.

The whole of the figures given above are somewhat further complicated by the observation that, in a certain number of cases, an eye which shows no spontaneous pulsation on one occasion, may do so on another. An observation of similar bearing is that the force of the pulse can sometimes be observed to differ quite distinctly on different occasions, being sometimes stronger and sometimes weaker. This is in keeping with Bailliart's observations; indeed he went so far as to establish a separate category in his classification for the eyes in which the venous pulse came and went from time to time; his figure for these was no less than 21 per cent. of the total examined.

Having to some extent cleared the ground by detailing the results of the observations above recorded, the occasion appears opportune for a statement in general terms of some of the lessons which may be learnt therefrom. A certain amount of repetition seems to be unavoidable, and for this no further apology need be offered.

As has already been said, it is a very difficult thing to form a clear idea of statistics relating to the venous pulse. In some subjects such a pulse is present in both eyes; it may then be so weak as to be almost imperceptible, requiring the closest attention for its detection, or so strong, that even a careless observer could not easily miss it; between these all grades exist. Then again, it may be present in every single one of the venous trunks on the disc, or it may be absent in one or more of these; it does not even follow that when present in all it is of equal strength in all. Indeed, this is very far from being the case, for where there are three trunks, it may be strong in one, moderate in another, and weak or absent in a third. We shall return at a later date to consider the influence on this pulse of pressure exerted on the veins by arteries which cross them obliquely or at right angles.

In other subjects, we find the total absence of a pulse in the veins of both eyes, or again, we may find a pulse in one eye and not in the other.

When we come to study the influence of pressure applied with the finger to the eyeball, the complications increase. It must be understood that in doing so, a definite line of conduct must be observed, if a comparison of the results obtained is to be of any value. The writer, throughout this series of experiments, applied digital pressure through the lower eyelid, or through the external

commissure, increasing it steadily until the flashing diastolic pulse was seen, and then stopping it, or at least being careful to go very little beyond this point, and then only in carefully selected and healthy eyes. It is of special importance that the early pressure should be light and gradually increased, and that the effects of light pressure and of the later heavier pressure should be carefully differentiated.

In a number of cases the application of light pressure will increase a pulse already present, or will elicit one not previously observed. Rarely, it will speedily abolish a pulse previously present. The continued increase of pressure will usually result in a speedy abolition of all venous pulse, but rarely an actual increase of the pulse may be observed, and this may go on right up to the point where a diastolic arterial pulse is produced. In such a case a very interesting phenomenon may be observed, if by good fortune the vein and artery lie parallel to each other and not too far separated for easy observation. The writer has been fortunate enough to get this combination in several cases. Under these circumstances, it can be clearly seen that the diastolic arterial pulse alternates with the venous pulse; when the artery is at its fullest, the vein is emptiest and *vice versa*. This is only what might have been expected when we remember the conditions prevalent in the eye at the time of the appearance of the diastolic arterial pulse. During the short period that the artery is stretched to its maximum, the intraocular pressure is appreciably increased, while the venous pressure is at its lowest; on the other hand, during diastole, the artery flattens and the intraocular pressure falls at the very moment when the venous pressure is at its highest; hence the appearance of the alternation of the pulses above recorded. This matter has already been considered when we were discussing the diagram illustrating the anatomical and physiological factors which cause the pulse in the retinal vessels.

Next, a word must be said of those eyes in which not only is no spontaneous pulse present, but none can be produced even by the application of digital pressure sufficient to elicit the flash pulse in the retinal arteries. That this is by no means a rare event can be judged from the fact that the author's statistics of 200 eyes show it in 25.5 per cent. This is not very different from Bailliart's estimate of 30 per cent. for the same phenomenon. That writer's explanation of the absence of a pulse, even under pressure, is as courageous as it is interesting and original. He believes that the venous exit pressure in such cases lies steadily below the intraocular pressure, and that the circulation is maintained through the flattened wall of the vessel, kept sufficiently open for the purpose by its own rigidity. He supports his contention by the following evidence: If we lower the pressure of the globe in these cases by pressure or massage, or

if we raise the venous pressure by making the subject hold his breath, after a strong expiration, the venous pulse will appear. To these observations of Bailliart's the writer would add a corroborative item: In a certain number of cases in which the venous pulse is absent, and remains so in spite of digital pressure on the globe, it may be caused to appear, for a short period, by complete relaxation of the applied pressure. This phenomenon can only be observed in a small minority of cases, but its appearance in them is unmistakable. The obvious explanation would appear to be that we have been able to raise the venous pressure for the moment above that of the intra-ocular pressure during the ocular diastolic phase, though it still falls below it in the systolic phase. After a very short delay the pulse so induced disappears, presumably through the fall of the venous pressure to its previous low level once again.

The present would appear to be a favourable opportunity to discuss certain other phenomena met with in the eye, when the veins fill with blood in the relaxation-phase which follows the application of digital pressure. We shall take these in turn.

(A) In one case, in which there was no spontaneous pulse, no pulse under pressure, and none after relaxation of the pressure, a pulse was at once produced when light pressure was reapplied to the eye, whilst the veins were still engorged with blood. Here it would seem as if the rise in venous pressure overshot the stage of near balance between venous and ocular pressure, and established, for the time being, a condition in which an increase of intraocular pressure was necessary before the pulse could be produced. This will be better understood by reference to the next class of cases.

(B) It is frequently observed that when a pulse is either spontaneously present, or is elicited by digital pressure, but stopped after relaxation of firm pressure, it can be easily made to reappear by a further application of light pressure. Obviously we have to do with a transient rise in venous pressure, or with a fall in ocular pressure, or with both. In any case the result is a disturbance of the balance between the venous and ocular pressures; the former is raised relatively to such a level that it is above the latter throughout the cardiac cycle. The application of light digital pressure once again brings the ocular pressure up so close to the venous pressure that it is now above it during the ocular systolic phase of the cardiac cycle, and below it during the diastolic phase.

(C) The following phenomena are very difficult to explain. They are possibly of all the more interest for that reason. In the right eye of a certain patient there was no spontaneous pulse, whilst the left eye showed a distinct pulse. On applying digital pressure, a pulse appeared in the veins of the right eye, and was strengthened in those of the left eye. Firm pressure was applied, and the retinal veins became engorged with blood; no pulse could now be observed

in them, nor could one be elicited by again applying pressure to the eyeball.

The Phenomena observed on Relaxation of Digital Pressure

If, after applying firm digital pressure to an eye, up to the point of producing the diastolic arterial pulse, the finger is removed whilst the disc is steadily observed, certain phenomena appear, which, so far as the writer is aware, have hitherto escaped record. The whole disc blushes pink, or even darkish red, the veins are markedly distended, and the venous pulse is abolished for the time being. After a variable period of from seconds to a minute or longer, the disc resumes its normal colour, the veins go back to their usual calibre, and the pulse returns. It is quite clear that we have here to do with an artificially induced rise in the venous pressure, which is sufficient to keep that pressure above the intraocular level throughout the phases of the cardiac cycle. It is a much more difficult matter to decide whether this change is brought about by a fall in the general intraocular pressure, or by a rise in the venous pressure due to a damming up of the blood in the vessels of the eye as a result of obstruction to outflow, or by both. It is quite likely, indeed it is practically certain, that firm pressure on the eyeball empties, to some extent, the great choroidal reservoir, whose importance in maintaining the level of intraocular pressure has been insisted on by Magitot. The effect of a partial emptying of this reservoir would be a proportionate lowering of the intraocular pressure, a state of affairs which would soon be righted with the re-establishment of the normal vascular conditions in the choroidal vessels. On the other hand, the obstruction, partial or complete, of the venous outflow would result in the raising of the pressure in the vessels of the eye right back to the arteries, and even in the arteries themselves; this might be expected to be attended by an increased storage of blood in the arteries and capillaries, which storage, on the moment of relaxation of the pressure, would lead to a flushing of the veins with blood. An observation of the fundus whilst pressure is being applied, would certainly not lead one to believe that blood was being stored up in the capillary circulation; such a view is contradicted by the pallor presented. On the other hand, it seems certain that the pallor of the central ends of the veins does not really indicate their absolute closure and the cessation of the flow of blood through them, as it has been assumed by some to do. We have several reasons for such a view: (1) There is our knowledge of the outstanding fact that an obstruction to a flow of this kind leads to a rise in the pressure behind, and that cessation of flow is only reached when the pressure throughout the organ is equal to or above that of the maximum systolic pressure; (2) these phenomena of flushings and palings can be produced by light pressure,

insufficient to provoke a diastolic arterial pulse, or even to stop the venous pulse, and sufficient only to increase the latter; this is clear evidence that the circulation through the capillaries has not really been stopped, for the capillary pressure must be higher than the venous; (3) a venous pulse may sometimes be seen right up to the production of a diastolic arterial pulse, becoming stronger and stronger, until the two pulses beat side by side. It would be difficult to explain such a phenomenon, if the venous exit flow had really ceased.

Looking at the question all round, the probable explanation of the fundus appearances observed on relaxation of digital pressure, is a dual one: (1) Intraocular pressure falls temporarily as a result of the emptying of the choroidal reservoir by the force applied, and (2) the arteries become over distended, as a result of the obstruction to the free onflow of the blood through the capillaries and veins, and empty themselves the moment an opportunity offers of doing so.

A series of eyes was examined with a view to study *the possible influence of the pressure of the arteries upon the veins on the production of a venous pulse.* Such an influence was suggested by Priestley Smith (this journal, Vol. II, pp. 264-5), as accounting for a certain number of cases of the kind, and the writer was therefore led to study the subject in some detail. This could best be done by selecting those cases in which one or both eyes showed a difference in the manner in which the arteries crossed the different veins. For the moment we may forego any discussion of the grounds for assuming that an artery crossing a vein necessarily does compress it. It is obvious that for the purposes which we have in view, the conditions required are that the different branches of the retinal vein in the neighbourhood of the optic disc should show widely different relations to the branches of the retinal artery. Where every venous branch is crossed under nearly similar conditions by an arterial branch, or when not one of them is so crossed, no materials for comparison exist. All such cases were excluded from the series, only those eyes being selected in which one or more vessels were distinctly crossed by arterial branches, whilst one or more of them showed no such relation to the arteries. In all, 35 patients were examined before it seemed certain that definite results had been obtained, and in these 35, 56 eyes were found to provide material for consideration and study.

It was quite frequently observed that when one vein was markedly crossed by an artery, and another was free from such crossing, the pulse was considerably more marked in the latter than in the former. Sometimes, indeed, the most markedly crossed vessel was the only one which showed no pulse. At other times the crossing or non-crossing of the veins appeared to have no relation whatever to the presence or absence of a venous pulse. Much less commonly, the

compressed vessel showed the most marked venous pulse, or the only such pulse recognizable. This result was so unexpected as to be a little staggering, and the actual figures may therefore be of interest. Of 56 eyes only 6 showed an increased pulsation in the cardiac segment of veins crossed on their surface by arteries, as compared with those not so crossed, while 22 showed a diminished pulsation. In 28 no possible difference could be observed in the pulse noted in the various veins, despite the great difference which existed in these eyes in this matter of the crossing of the veins by the arteries. In close connection with the last statement, a further important observation deserves to be recorded, viz., that in a number of eyes the pulse was found to vary greatly in different venous branches, being sometimes present in one, absent in another, and weak in a third, or showing similar variations of the same kind, despite the fact that the degree of arterial crossing was alike in all three. The same thing was also seen when not one of them was crossed at all.

These are but a few broad deductions from a mass of material, the main lesson running through the whole of which appears to be either that there is no connection whatever between the manner in which the artery is crossed by a vein and the venous pulse therein, or else that other factors enter into the case which, in a large number of instances, entirely obscure such action as arterial pressure may tend to exert.

It is of interest to consider for a moment the grounds for supposing that when an artery crosses over a vein pressure is necessarily, or even probably, transmitted to the vein walls in consequence of the anatomical relations between the two. *A priori*, it does not seem very likely that any such pressure would be exerted, nor does clinical observation lead us to believe that it actually is so exerted, always provided the vessels are healthy. The indentation of veins by thickened arteries must be admitted to be in a different category. This raised the suggestion that the increase of venous pulse, when present would probably be found to be correlated with a definite thickening of the arterial wall of the superjacent vessel. No evidence in support of this could be obtained, though a number of eyes in which retinal arterial sclerosis was present were carefully observed. This is perhaps not very surprising, since the venous pulse, presumed to be produced by an overlying artery, must depend to some extent on the amplitude of the variations in the calibre of the vessel, and we believe that such amplitude is at its lowest in vessels attacked by arterial sclerosis. (R. Foster Moore, *R.L.O.H. Rep.*, Vol. XX, 1915.)

Another point of interest—The venous pulse, seen in apparent connection with the crossing of a vein by an artery, is usually noted on the cardiac side of the line of compression; it may,

however, be most obvious on the capillary side of this line. The explanation afforded would be essentially the same in either case. The argument is, that as the artery expands and contracts, it alternately dams back and permits the flow of the venous blood in the subjacent vessel. Above the line of constriction every wave of arterial dilatation will give rise to a banking up of blood in the veins, while below it the segment of vessel on the cardiac side is permitted to empty itself. Again, with every constriction of the artery the blood that has collected behind the line of obstruction is again permitted to flow onwards, and with that the previously comparatively empty segment refills with blood. It would not, therefore, be difficult to explain a pulse on either side of the line of obstruction, provided that we met with such at all constantly. The question is, do we? Such work as the writer has been able to do on the subject causes him to doubt whether we do.

The Relationship of the Venous Pulse to Glaucoma

It has been generally believed that in glaucoma, we get an increase in the venous pulse. Another belief has gone hand in hand with this, viz., that a similar increase is met with after the use of mydriatic drugs. Bailliart has attacked the first of these dogmata and has contended that the view is entirely due to a confusion between the conditions which produce an arterial pulse and those which bring about venous pulsation. Briefly put, his argument is this: There is in the normal eye a large and definite difference between systolic and diastolic arterial pressure on the one hand and between diastolic arterial pressure and intraocular pressure on the other. When intraocular pressure rises to the level of diastolic arterial pressure, the arterial circulation suffers an interruption during a greater or less part of the cardiac cycle; the appearance of the diastolic pulse is therefore an evidence of the rupture of the normal relationship between the retinal arterial pressure and the intraocular pressure. On the other hand, the appearance of the venous pulse is merely an evidence that the venous exit pressure and the intraocular pressure are so closely balanced, that the small volume of blood thrown into the eye at each systole suffices for the moment to place intraocular pressure above venous pressure, whilst its escape during the arterial diastolic period suffices to lower the intraocular pressure below the level of the venous pressure. This, Bailliart argues, may occur equally under conditions of high, common, or normal pressure. However attractive such a thesis may be from a scientific point of view, it may safely be said that it is in opposition to a large volume of ophthalmological opinion, which bases itself upon clinical experience. The writer was among those who believed unhesitatingly that a marked venous pulse is a significant feature in glaucoma cases, and

he turned to his records confidently expecting a confirmation of this view, only to find that, in a number of his cases, the degree of venous pulsation had not been noted. This defect in his observations has since been remedied, but it will take some time before the records are sufficiently numerous to enable him to speak on the subject with the confidence and certainty that are desirable. If in a series of a hundred glaucoma cases the records of venous pulsation were available for comparison with those of the hundred normal cases dealt with at an earlier part of this paper, it should not be difficult to decide on the value to be attached to venous pulsation in the diagnosis of the disease. Although the available data are not sufficient to decide the question definitely, there are certain points which seem comparatively clear: (1) A strong venous pulsation is a not uncommon feature of the glaucomatous fundus. It is, of course, difficult, when speaking from limited statistics, to be sure that we have here to do with cause and effect, but the broad impression gained is that such is really the case. (2) In glaucomatous eyes in which marked venous pulsation has been observed before operation, later examinations following the successful relief of tension have shown its disappearance or its very marked diminution in a number of instances. (3) Notwithstanding all this, marked venous pulsation is certainly not an invariable feature of the glaucomatous eye; indeed, there may be a total absence of venous pulse in a globe whose tension is undoubtedly pathologically high.

Closely associated with the question we have just been discussing is the widely prevalent belief that venous pulsation is increased in normal eyes under the influence of mydriatics. A careful examination of a number of patients before and after mydriasis, has not lent uniform support to this suggestion. The origin of the idea is obvious: If we raise the pressure of an eye by indenting it lightly with the finger, we observe that in a number of cases the venous pulse, if already present, is increased, or, if not present, is induced. We are not unnaturally led to conclude that the same thing is likely to happen if we raise the pressure of the eye in any other way, as we are prone to assume, perhaps not always correctly, that we do when we bring about mydriasis. In any case the facts are of interest. The instillation of a mydriatic will sometimes cause a very marked increase in venous pulsation, while in others, the influence of the drug in this direction seems negligible. This observation gains added interest when we remember that it is in conformity with what we observe when we increase the intraocular pressure by pressing on the eyeball with the finger. If the writer has been correct in the suggestion put forward above that a pathological rise of intraocular pressure sometimes causes an increase in venous pulsation, and at others fails to do so, the interest deepens still farther. Running

through all these observations of the eyeball in health, in disease, and under the influence of drugs, there is on the one hand, a broad tendency towards obedience to definite physical and physiological laws, and on the other hand, an elf-like erratic element, which is extraordinarily puzzling, and which leaves on the mind the impression that there is some very important factor which we have hitherto been unable to identify or comprehend. May it be that this has to do with the anatomical and physical conditions which govern the escape of blood through the ocular tunics, or with the hydrodynamic conditions prevailing in the reservoirs into which the blood flows on its exit from the eye? If this question could be satisfactorily answered, it is possible that we should be nearer than we have ever hitherto been to the elucidation of yet another problem, viz., that of the elemental difference between simple and congestive glaucoma.

THE HALOS OF GLAUCOMA

BY

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AN endeavour to obtain precise information as to the nature and character of the halos seen by glaucomatous eyes, and under certain other conditions, speedily reveals the fact that there is but little accurate information to be obtained from the existing medical writings on the subject. Apparently few have thought it worthy of careful study, and the very great majority of ophthalmic surgeons are content to record the observation of coloured rings by a patient, without troubling to investigate the matter any further. The writer feels that this attitude is a mistaken one, and believes that valuable results may be obtained from a systematic study of these halos. In order to clear the ground it must first be stated that the coloured rings may be seen subjectively by an eye under a number of different conditions: (1) In the presence of the corneal oedema that accompanies a rise in ocular tension (the true glaucomatous halos). (2) The coloured rings seen by an eye which has been treated with African arrow-head poison or with silver nitrate are probably due to a transitory corneal oedema induced by the drugs, and therefore may be assumed to be closely comparable physically with those of true glaucoma. (3) When the surface of the eye is covered with thick mucus, faint coloured rings may be seen round a flame; these disappear at once on washing the eyes and are not of serious import. The writer believes them to be due to the presence in the mucus of vast numbers of tiny air bubbles. (4) When the pupils of certain patients are dilated by a mydriatic, somewhat faint,

but quite definite, coloured rings can be constantly observed; Druault has suggested that these rings are to be attributed to diffraction of the light by the lens fibres at the level of the pupil (Morax). (5) In certain cases of nuclear cataract, distinct coloured halos can be observed; these are probably allied to Druault's diffraction phenomena. (6) The normal eye can, under suitable conditions, see coloured halos round bright lights in the dark. These halos are fainter than those seen in glaucoma. (7) When lycopodium powder is dusted on a glass plate and a source of light is examined through the film so formed, definite colour rings are seen. The same is true of a steamed plate.

This is but a bare outline of a large and interesting subject, which the writer hopes to deal with very much more fully on a later occasion. His object in bringing the matter forward at the present time is to direct the attention of ophthalmologists to the extraordinary differences in the statements made by various observers as to the arrangement and the measurements of these halos. Quite recently he was fortunate enough to have the opportunity of examining a particularly intelligent and observant professional man, aged 36, who had been watching and attentively noting the nature of his halos before he sought advice for the relief of an intermittent subacute congestive glaucoma. The order of the colours was as follows: dark blue in the centre, then green, and yellow on the outside. He was examined in a dark room, at a distance of 11 ft. 7 in. from a moderately bright frosted electric light, seen through a diaphragm 1 in. in diameter, and was first given a little time to gain a clear conception of the measurements of the different rings. The room was then dimly lit by ceiling lights, and the radii of the coloured rings were measured in turn on a long sheet of paper, one end of which was made to correspond with the vertical centre of the source of light under observation. The edges of the rings were then marked off on the paper. From these measurements the subtended angles were estimated in the usual way. The total measurement of the halo was found to be 8.5°.

The coloured halos seen through a steamed plate start with a measurement of about 9.5° and rapidly contract as the small steam globules run into larger ones. This is in accord with what we know of the principles of diffraction, for the smaller the discs or globules that determine the halos, the larger the halos and *vice versa*. The lycopodium halos have a constant measurement (in the writer's experience of one sample of lycopodium) of 2° to 2.5°. The physiological halos referred to under (6) above are likewise constant in measuring about 4°. On the other hand the figures given us for the glaucomatous halos are only 2° to 2.5°, according to one observer and from 7° to 8°, up to 10° to 12°, according to others. Putting, aside the first estimate as irreconcilable with all other experience

the writer would suggest a simple explanation of the great difference in the results of the remaining observers. It is accepted that the cells which cause the diffraction phenonema belong to the corneal epithelium (and possibly to the endothelium). As these cells enlarge under the progress of oedema, the diameters of the halos they cause will correspondingly diminish; thus the size of the halo observed will probably differ according to the phase of the pathological process.

The writer ventures to place this note on record in the hope that others, who have the opportunity of making similar measurements on glaucomatous subjects, will do so, and will either publish their results, or be kind enough to communicate them to him. The distance at which the measurement is made is not of much importance, provided that it is sufficiently great to admit of the easy measurement of the radius of each circle. Knowing the distance from the eye to the observed source of light (a) and the measurement of the halo from edge to edge (b), a simple formula enables us to calculate the angle (θ) required, viz., tan. $\theta = \frac{a}{b}$; a reference to a logarithm table completes the calculation, and gives us the measurement of the angle in degrees. To put the matter approximately for those who desire to avoid all mathematical calculations. If the light is 10 ft. from the observing eye, the diameters of the halos will be as follows:—For 2°, 4⅛ ins.; for 3°, 6¼ ins.; for 4°, 8½ ins.; for 5°, 10½ ins.; for 6°, 12⅝ ins.; for 7°, 14¾ ins.; for 8°, 17 ins.; for 9°, 19 ins.

SAFETY IN OPHTHALMIC OPERATIONS

BY

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WHILE the elimination of suppuration in ophthalmic operations is probably an unattainable ideal, it is certain that the irreducible minimum has not yet been reached, and to that end our most earnest efforts must be directed. No surgeon is perfect in his technique, and it appears reasonable that if one could practise the best points of many surgeons, one would be as nearly perfect as human error would allow. There is nothing original in the points set out below—they are a summary of lessons learned from observing the work of several British ophthalmic surgeons.

The remarks apply, of course, largely to the operation for extraction of cataract.

Preliminary examination, culture and treatment.—This is of first

importance. The condition of the adnexa must be minutely observed, and appropriate treatment used for conjunctivitis and blepharitis till the condition is cured. Before operating, the structures must be clinically and culturally satisfactory.

Swabs should be taken from both fornices and 48-hour cultures examined by a bacteriologist. Before swabbing, it is necessary to press on the lacrymal sac in such a way as to cause the smallest quantity of fluid present in the sac to flow back through the canaliculi. Cases of mild infection limited to the sac will thus be detected, and neglect of this point may quite well explain the occurrence of suppuration in spite of a clean culture from the conjunctiva. For 24 hours previous to culture, no antiseptic treatment is applied to the eye.

A 48-hour culture is necessary for the reason that the pneumococcus cannot be excluded by a shorter incubation period and staphylococcus aureus sometimes does not exhibit the yellow of its colonies for 36-40 hours. The commonly found organisms that debar operation are: pneumococcus, pneumobacillus, streptococcus and staph. aureus. Frequently, operations are done without ill result in the presence of m. catarrhalis and b. Morax, but it is not good practice and they are usually quickly eradicated. A strain of staph. albus is sometimes found whose colonies show haemolysis when grown on blood agar and this should be regarded as a potentially suppurative organism. Staph. albus and b. xerosis are not generally considered to contra-indicate operation but one is justified in inquiring whether they may not be the cause of some of the cases of irido-cyclitis which not infrequently follow extraction. It is certainly not wise to operate if culture shows a profuse growth of either of these organisms.

The clearing of a conjunctival sac of harmful organisms is, in Hospital practice, usually a matter of a week's treatment, but sometimes several lotions will be tried before a clean report is obtained. Thrice daily washing out with Lot. Hydrarg. Perchlor., 1 in 10,000, and daily painting of the conjunctiva with silver nitrate solution, gr. x to the ounce, will be found the most useful, but is unnecessarily drastic in cases of mild infection, which clear up well with Lot. Zinci. Sulph., gr. 1 to the ounce, three times a day, and Guttae Protargol, 10 per cent., once daily.

Obstinate infections will often clear up quickly with the use of copper sulphate drops, gr. $\frac{1}{4}$ to the ounce, and an organism which has defied treatment will frequently disappear when the lacrymal sac is treated by washing out with boric lotion followed by the injection of a few drops of 5 per cent. protargol. It will save time if this treatment of the sac is carried out as a routine in all cases which have given an unsatisfactory culture.

The expression of the Meibomian glands by a blunt glass rod is,

in some cases, a useful manoeuvre which is often overlooked and gives good results.

Of course, a certain number of cases of chronic conjunctival and lid infections never improve to such an extent as to be clinically normal and in these cases, even in the presence of a pyogenic organism, good operative results have been obtained by washing out with Lot. Hydrarg. Perchlor., 1-4000, immediately before operation. This is not sound surgery, and prolonged efforts must be made to render the eye and adnexa clinically and culturally clean before taking this risk, which is seldom justifiable in an operation of so little urgency as extraction of cataract.

The presence of a mucocele is an absolute bar to operation. The sac should be excised and the puncta sealed by touching with the cautery. This applies also to the side which is not to be the subject of operation. It is unlikely that the organisms enter the operated eye by contamination during binocular dressing, but probably the 'clean' sac is the subject of a mild infection which does not give rise to pus and would be detected if before culture the sac were firmly pressed. The frequent occurrence of a purulent conjunctivitis in the other eye at the time of a suppuration in an operated eye, is best explained by the presence at operation of a mild, undetected infection of both sacs which becomes manifest after closure of the eyes for 24 hours—the most common after-treatment. This would appear to be an argument in favour of leaving the eyes unbandaged following operation; but if the conjunctiva, lids and sac are thoroughly investigated and found clean, no harm results from tying up the eye.

Eczematous and septic conditions of the skin of the face and any sepsis elsewhere give rise to the risk of contamination, and may generally be taken as an indication of lowered resistance to pyogenic organisms.

Beyond cutting the lashes, no preparation is necessary in a 'clean' eye, and in order that the surgeon may form an accurate estimate of the condition of an eye, no treatment should be applied on the day of operation before he has seen the case.

All lashes should be cut close to the skin. Those not covered by the speculum are a source of risk during operation, and all provide risk during after-treatment.

The Operation.—Operator and assistants should wear sterile coats or gowns with closely fitting sleeves. Caps, completely covering the hair, avoid the risk which occurs in ophthalmic operations more than in any other, of operator's and assistants' heads coming into contact and sending a hail of organisms over the field of operation. Virulent organisms are always present in the throat and are projected many feet by speech, many yards by coughing. The wearing of masks should be an absolute rule, and

unless the surgeon wears glasses, the mask should cover the nose as well as the mouth. The rule should apply to all in the theatre who have to do with "things sterile"—instruments, towels, porringers, etc.

A reasonably thorough cleansing of the hands and wrists with sterile liquid soap, followed by a dip for a minute in some weak antiseptic solution combined with spirit is a satisfactory hand toilet. The hands must be thoroughly dried on a sterile towel.

It is almost never safe to trust to the sterility of the patient's head towel, which is so easily contaminated during the process of putting it on—never wipe instruments on the head towel.

Swabs for use during operation should be in a sterile porringer.

The chest towel is always liable to be soiled by the patient coughing, and should not be regarded as sterile. It would appear advisable to place gauze over the lower part of the face of a bearded patient, but this simply serves, if he coughs, to guide the stream of organisms upwards towards the field of operation.

The skin of the lids and surroundings should be painted with Tr. Iodi, and skin so treated should not be regarded as sterile but as being less septic than before.

A good and well tried wash-out is Lot. Hydrarg. Perchlor., 1-10,000. During the wash-out, one must be careful to avoid lotion overflowing on to the skin and subsequently running back into the conjunctival sac. The head should be tilted a little so that the lotion leaves the eye by the outer canthus, and the lids should be mopped dry on completing the wash-out.

Instruments, whether sterilized by boiling or by immersion in an antiseptic, must be used dry. Instruments at Moorfields are placed in racks in a dish with perforated bottom and a removable lid, and the whole dish is immersed in boiling distilled water to which a little sodium carbonate is added. After 5-10 minutes' boiling, the dish is lifted out and sufficient time is then allowed for the instruments to drain and to cool. When the lid is removed, the operator can handle the instruments with the knowledge that they are exactly in the condition in which they left the sterilizer—a matter of some doubt when instruments are handled in uncovered racks.

None but the simplest instruments drain throughly dry. All instruments should be shaken free of moisture to avoid the possible infection of the drop of water by the grasping finger, on its course down to the "working end" of the instrument and so on into the eye. For the same reason, the shaking must be done with the "working end" of the instrument held uppermost.

Gloves cannot be worn and hands cannot be rendered sterile, so that any part of an instrument that has been in contact with the skin cannot be considered sterile. In using double-ended

instruments, it is not easy to avoid contamination of the end not in use at the time and on this ground, such instruments should be discarded.

It is necessary to emphasize the mistake of touching anything with the "working end" of an instrument except the actual tissues it is meant to manipulate. Generally it is considered that a surgeon, if he keeps within the blades of the speculum, is surgically clean. The speculum is certainly a boundary to be noted, but within that again there is a boundary equally as important and not sufficiently recognized. Nothing that has touched the conjunctiva should enter the globe. If one accepts the under surface of a conjunctival flap as being generally safe, this rule can be observed in nearly all cases.

A speculum with both blades solid is the cleanest type, and can, in most cases, be used without unduly cramping the field of operation. During its insertion, the speculum is very often soiled by contact with the skin and lashes—if the latter have not been cut. The lower blade should first be inserted with the upper blade turned well away, with the lids held apart and the patient looking upwards. It is then easy to insert the upper blade in the usual manner with the patient looking downwards.

In swabbing, forceps should invariably be used for holding the swab. The smaller the swab, the less likely it is to be contaminated in use. "Very small swabs, used only once" should be the rule.

Certain manoeuvres in the performance of the cataract operation should be mentioned as hindering the entrance of organisms into the eye. A sufficiently large conjunctival flap should be aimed at —ideally, one that will seal the whole length of the section. Cutting the capsule with the knife on its way across the anterior chamber ensures that one fewer instrument enters the eye and, in skilled hands, does not increase the risks of the operation. In the expression of the lens, frequent, successive, light pressing movements on the lower half of the cornea are to be avoided, for the reason that they induce a pumping effect, causing at the wound a to and fro movement of fluid; small, no doubt, in quantity but possibly contaminated by the conjunctiva. No method of removal of soft lens matter is perfect as regards asepsis. Probably irrigation involves more risk than one or two slow strokes on the cornea, while a curette depresses slightly the posterior lip of the wound. Fluid that collects at the canthi and in the lower fornix after completion of the section should be mopped dry.

At the first dressing—24 hours after operation—the lids must be soaked in warm perchloride lotion and mopped dry before opening the eye and, during the dressing, the lids and canthi must be kept dry. Drops used must of course be sterile, and if they are sufficiently warmed, the patient will seldom "squeeze."

The observance of all these points does not mean prolonging the

operation of cataract extraction, the safety of which must always depend largely on speed and the absence of unnecessary manipulations. One may surely hope that by the practice of a careful technique, the percentage of suppurations will be reduced. Is it too much to hope that fewer cases will show after operation the condition of "quiet cyclitis" frequently attributed to auto-infection?

ANNOTATIONS

Diploma in Ophthalmic Medicine and Surgery of the Royal College of Physicians of London and the Royal College of Surgeons of England

There are individuals who delight in estimating the possible output of the existing coal mines, and, after calculating the time it will take for them to become exhausted, make our flesh creep with the calamities which are then likely to ensue. They overlook the fact that probably fresh coal fields will be found, and that the ingenuity of man is likely to discover new and more efficient sources of energy than that supplied by coal.

So also, at the commencement of each medical year, we meet with letters and articles in the public press giving the number of new students entering the medical profession, comparing it with the present number of practitioners, and then drawing gloomy pictures of how the profession is becoming overcrowded. These writers overlook the fact that there is a large amount of medical work being carried on by those who have not received any medical training, and that new discoveries are from time to time being made which open up entirely new fields of work for medical practitioners.

By Thomas Young's discovery of astigmatism in 1800, by Airy's introduction of cylindrical lenses for its correction in 1827, and by Donders' great work on accommodation and refraction of the eye in 1864, a new means was opened up for the relief of pain and suffering of an incalculable amount. The provision, however, of medical men competent to undertake the work it involves, even now, falls far short of that which is required. The training and experience which is sufficient to obtain a qualification for the practice of medicine does not ensure adequate skill for the correction of errors of refraction with glasses, nor for the use of the ophthalmoscope.

The Ministry of Health, soon after it was first established, recognized this and applied to the Royal College of Physicians and Surgeons in London to see what could be done to enable them, when required, to select suitable medical practitioners to carry out

ophthalmic examinations. The Conjoint Examining Board of the two Colleges, with commendable promptitude, took the matter in hand and decided to institute a Diploma in Ophthalmic Medicine and Surgery, the possession of which would be a guarantee that the holder had passed through a suitable course of study in ophthalmology, and that his knowledge of the subject, as tested by an examination, had proved satisfactory.

The Conjoint Board, with the assistance of representatives of the Council of British Ophthalmologists, drew up regulations for the Diploma, which were approved of by the Councils of the two Colleges, and the first examination for it was held in July, 1920.

It was not the first Diploma in Ophthalmology to be established in this country, one having been instituted at Oxford in 1910, through the foresight and energy of the late Mr. R. W. Doyne. The conditions required of candidates before presenting themselves for examination are very similar for the two Diplomas. For both candidates have to possess registerable medical qualifications, or be graduates in medicine and surgery of certain recognised Universities. For both evidence has to be produced of a year's attendance at an Ophthalmic Clinic in connection with a recognized institution. For the Oxford Diploma a term's attendance at a course of instruction at Oxford is essential. For the Colleges' Diploma it is not stated where the required courses of instruction have to be pursued. For the Oxford Diploma one examination, comprising all subjects, is held once a year. The examination for the Colleges' Diploma is divided into two parts; the first dealing with anatomy and embryology, physiology and elementary optics; and the second with ophthalmic medicine and surgery and ophthalmic pathology. Both parts of the examination are held twice a year, in January and July. A candidate who has passed the first part can, if he desires, present himself for the second part the same month.

That this Diploma of Ophthalmology established by the Royal Colleges in London is meeting with increasing recognition and favour, is shown by the number of candidates that present themselves for it. For Part I. there were, in July, 1920, 25 candidates; in January, 1921, 34; and in July, 1921, 31. For Part II. there were in July, 1920, 11 candidates; in January, 1921, 9; and in July, 1921, 25. The standard of marking for the examination is in accordance with the object for which the Diploma was established; it is such as a medical man who has attended a year's practice at an ophthalmic clinic might be expected to attain. The standard is not equal to that which might be required for appointment as ophthalmic surgeon to a hospital, or for a post as teacher of ophthalmology. This is brought out by the number of candidates referred at each of the examinations. Of the 90 candidates who presented themselves for the first part 27 were referred; of the 45

candidates who presented themselves for the second part 6 were referred.

An indirect benefit to ophthalmology, arising out of the establishment of the Diploma, has been the stimulus it has given to the study of the preliminary scientific subjects upon which the practice of ophthalmology ought always to be based.

The few classes held in former days dealing specially with ophthalmic anatomy, physiology, and optics, were but scantily attended. Now that an examination in these subjects has to be passed to obtain the Diploma, a demand for instruction in them has arisen. We find that at three of the special ophthalmic hospitals in London the necessary provision to meet this demand is being made.

At the Royal London Ophthalmic Hospital, Moorfields, special courses in the preliminary subjects are held twice a year, immediately preceding the date of the examination. The lectures on physiology are given by one of the surgeons of the hospital, Mr. Herbert Parsons, F.R.S., lectures on anatomy are given by Mr. Hillman, demonstrator of anatomy at the Middlesex Hospital. Lectures on optics are given by Mr. Hopwood, lecturer on physics at St. Bartholomew's Hospital.

In conjunction with the Royal Westminster Ophthalmic Hospital a complete course in the subjects for Part I of the examination for the Diploma, is held at King's College, lasting over a period of four weeks. The Central London Ophthalmic Hospital also advertises courses of instruction in these subjects arranged in conformity with the requirements of the Conjoint Board for the Diploma.

At the National Hospital for Paralyzed and Epileptic a special course of lectures and demonstrations in the neurological aspects of ophthalmology has also been instituted in view of this examination, and has been well attended.

Ophthalmic surgeons of the present day, when they recall the somewhat haphazard fashion in which they had to acquire instruction in these fundamental scientific bases of their art, may well envy the coming generation the new facilities which are now provided for them.

The Standardization of the Axes of Cylindrical Lenses

The report on the standardization of the notation of the axes of cylinders was published in this Journal (July, 1921).

The Council of British Ophthalmologists considered in detail eight different notations in use, and gave good reasons for the adoption of one of them, namely, in their own words, "That in

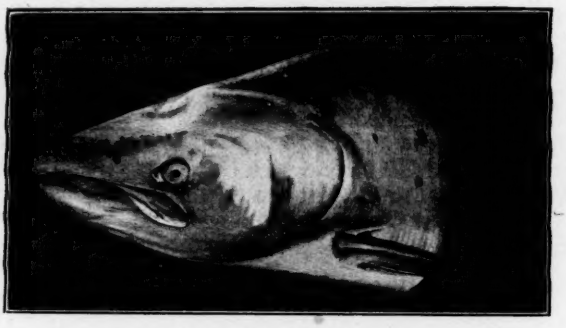
which a similar notation is employed for each eye, the zero lying at the observer's left side and the scale being read below the horizontal with 90° at the bottom and 180° at the right side."

We know that a surgeon often hesitates to change the method he has become accustomed to, but the Council points out sound reasons for the general adoption of one standard and we would like to draw the attention of practitioners to the advantage of following their advice. If it was adopted at the hospital clinics it would soon become universal, and we venture to think the inconvenience to those at present in practice would soon disappear.

The method suggested is now the standard notation of opticians who usually transcribe all prescriptions given them into it before sending them into the workshop. The most important point of all is to get everyone to use the same method, and it would help to hasten this event, if some of the leading London clinics would send a note for publication in this Journal to say that it was the method that they advised and used.

The White Spot Disease of Salmon

The severe drought of this summer has caused the appearance of a disease in salmon called the white spot disease. The name is derived from a white spot that appears in a depression over the brain and is accompanied by complete blindness. The disease was also noted in the severe drought of 1880 in the Lews by Captain Newall. The *Fishing Gazette* of September 24 publishes a letter from Mr.



From the *Fishing Gazette.*

W. L. Calderwood, Inspector of Salmon Fisheries for Scotland, in which he states that fish do go blind from the effects of bright light from which they are unable to escape. He had also examined several affected fish in 1905. He gives a drawing of the head of an affected fish, and adds that in bad cases the blotches may extend

for four or five inches down over the vertebral column. Although he states that the central nervous system in fishes is powerfully disturbed by bright light he unfortunately gives no account of any pathological examination. It is also known that fish kept in aquaria may suffer in the same way, and it is of importance to provide them with plenty of shade. The editor adds in a footnote that Professor Hofer in his work on "Diseases of Fish" does not mention light as a cause of blindness, but draws attention to the curious fact that a healthy fish placed on its side does not turn its eyes with its body, but that the eye sockets turn round the eye so that the pupil is hidden by the orbital margin. An examination of the brain and eyes of some of these fishes would be of considerable interest in comparative pathology.

ABSTRACTS

I—ACUTE CEREBRAL AMAUROSIS OF INFANCY (GAY)

Barrett, Sir James W. (Melbourne).—Fleeting amaurosis in children. *Med. Jl. of Australia,* August 28, 1920, and *Med. Press and Circular,* October 27, 1920.

A remarkable series of cases was described by Nettleship in 1884 (*Trans. Ophthal. Soc.*, Vol. IV, p. 243), where in young children cerebral symptoms associated with blindness were followed by recovery of the usual bodily health and of sight. In 1893 Dr. William Gay (*Roy. Lond. Ophthal. Hosp. Reports,* Vol XIII, p. 404) described six cases of this peculiar condition, to which he gave the name of "acute cerebral amaurosis of infancy." In 1902 the reviewer *(Reports Soc. for the Study of Dis. in Children)* described six instances of the disease under the title of "fleeting amaurosis," adopted by **Sir James W. Barrett** in the communication under abstract. His case in a female child of 7 years is unusual, since the disease commonly occurs in children of a much tenderer age. A month after an attack of so-called influenza, on her return to school, the patient found that she could not see the blackboard, and that her sight was better in a dim than in a bright light. The pupils were widely dilated and fixed, and the fundi and media were normal. R.V., with ametropia corrected, 6/36; L.V., corrected, 6/60. Complete recovery took place within eight days after the first examination.

S. S.

II—METHYL ALCOHOL POISONING

Jackson, Edward (Denver).—Methyl alcohol poisoning. *Amer. Jl. of Ophthal.*, February, 1920.

Edward Jackson, in an editorial note, goes into the symptoms and treatment of methyl alcohol poisoning, a subject which has exercised the public mind in America of late. He refers to a paper by Casey A. Wood and Frank Buller (published in the *Trans. Sect. on Ophthal. Amer. Med. Assoc.*, 1904, p. 412) in which attention was drawn to the fact that blindness occurred in 153 cases, and death in 122 cases, as a result of indulgence in " illegitimate " liquor. Measures were suggested for prevention of the condition. The salient symptom is blindness resulting from optic nerve atrophy. As a cause of toxic amblyopia methyl alcohol is said to occur more frequently than all other factors put together.

Clinical symptoms.—The earlier period of intoxication may show no visual disturbances. Transient insensibility may be followed by recovery without impairment of vision; or the symptoms may be delayed in type, and in a few days after apparent recovery severe gastro-intestinal irritation may set in, with rapid loss of sight. Complete blindness may last for a few days, vision gradually becoming restored. A secondary attack of blindness may follow in a few weeks, and this is usually permanent and incurable.

Optic nerve atrophy appears late, and there is generally blurring of the disc edges; ophthalmoscopically there is little to be seen in the early stages beyond slight congestion of the discs. The fields of vision may show large central scotoma early; later there is great irregularity and concentric narrowing.

Treatment eliminants.—Hot pack; Turkish bath; pilocarpin sweats; free ingestion of water; venesection, and spinal puncture. Potassium iodide may be tried, but it is doubtfully effective. Intra-venous injections of sodium bicarbonate for acidosis, and stimulation of respiratory excretion should be employed. Efficient emesis in the very early stages of intoxication may prevent death or blindness, but circumstances seldom allow of putting it into practice. In cases of food adulteration with the now palatable methyl alcohol instead of the ordinary variety, the patient is not aware of the deception until the onset of toxaemic symptoms; where indulgence in the drug is deliberate he is anxious to conceal the fact and does not readily seek medical advice. In many cases poisoning takes place through inhalation or contact with the drug in the course of employment connected with its manufacture, and the symptoms are somewhat insidious in their onset. All

cases of sudden amblyopia with gastro-intestinal symptoms should be regarded as suspicious.

Prognosis should always be guarded, and unless in the earliest stages is almost always grave. Idiosyncrasy plays a large part in the condition, and what might be an innocuous dose for one person might be fatal for another. Violent gastro-intestinal symptoms may develop late in the condition as a result of toxic affection of the nerve-centres.

J. HAMILTON MCILROY.

III.—ANNULAR OPACITY OF ANTERIOR SURFACE OF THE LENS

Colombo, G. L. (Parma).—On annular opacity (Vossius) and an undescribed form of opacity (coin shaped) of the anterior surface of the lens. (Dell' intorbidamento anulare (Vossius) e di una forma non descritta di intorbidamento (a moneta) della superficie anteriore del cristallino.) *Arch. di Ottal.*, Oct.-Nov., 1920.

Colombo's case was that of a soldier injured in a bomb accident two years previously. When seen by the author he had a small coloboma at the edge of the left upper lid about one centimetre from the internal angle. About 2.5 mm. from the limbus up and in there was seen a small pigmented scar. The pupil reacted to light and dilated fully with atropin except at the upper internal quadrant. On the surface of the lens a ring shaped, milky, opalescent opacity was present with a regular margin shading evenly off and about 2.5 mm. in diameter. An opacity of similar appearance and about 1.5 mm. in diameter occupied the centre of the ring. Between the internal margin of the ring and the external margin of the coin-shaped opacity the lens was not quite clear, but very nearly so. On dilating the pupil the external margin of the ring was radiated towards the periphery somewhat irregularly. The opacity did not interfere with the red reflex in ophthalmoscopic examination and the vision was normal. Six months later the opacity was even more obvious, but still did not interfere with vision.

Colombo discusses the literature of the subject and the mechanism of the production of these opacities. He points out that in previously recorded cases of Vossius' ring the opacity has tended to disappear in contrast with the case here recorded. These lesions are presumably due to alterations in the lens epithelium. The ring opacity is probably caused by the impression of the sphincter of the iris, while the coin-shaped opacity probably follows the direct blow of the cornea without the intervention of the iris.

A photograph which accompanies the paper shows the Vossius ring very clearly, but the coin-shaped opacity does not appear. A useful bibliography is appended.

E. E. H.

IV.—TUBERCULOSIS OF THE SCLERA

Collomb, A. (Geneva).—Tuberculosis of the Sclerotic. (Tuberculose de la sclérotique. Tuberculose dans le secteur scléral des vaisseaux ciliaires pericornéens et peripapillaires.) *Revue Générale d'Ophtalmologie*, June, 1920.

"Tuberculosis of the sclerotic occurring as a localised neoplasm, *tuberculoma* as it has been aptly called, must certainly count as one of the rarest localisations of ocular tuberculosis." The great question to decide is whether this tuberculoma is primary or secondary. If it could be proved primary then enucleation of the eye is justifiable. If secondary to some other focus in the body such operation is useless. **Collomb** relates one case of his own and refers to the work of his pupil Pierre Fietta (Thèse de Genève, 1919), who was able to collect from the literature—after subjecting each case to critical examination—only thirteen cases which satisfied the diagnostic requirements as pure tuberculosis of the sclera. Of these thirteen cases, ten occurred in the anterior vascular zone of the sclera (ciliary) and three in the posterior vascular zone immediately around the optic nerve. The author's arguments are too long to note in detail, but he concludes that this rare lesion, tuberculoma of the sclerotic, is a secondary tuberculosis, a metastatic localisation in the scleral vascular bundles surrounding the cornea, on the one hand, and the optic nerve on the other. He also concludes that these vascular communications are, more frequently than has been supposed, the seat of various infective localisations, and that, especially as regards the peripapillary region, certain ophthalmoscopic diagnoses must be revised.

This last point is an interesting one, regarding which the author's words may be transcribed. "There is one point in particular, regarded in the light of this new interpretation (i.e., localisation in the vascular bundles), in which some diagnoses appear to require revision. It has long been known, since the time of Demours, Cruveilhier, etc., that the optic nerve may be affected by tuberculosis in different portions of its path, and in particular at its papillary end. There are many works on this papillary tuberculosis (names given). These authors state that

such tuberculoses are often marginal, and on reading some of their remarks, examining their plates and following the evolution of their cases, the question immediately arises in one's mind whether a portion of these marginal tuberculoses of the optic nerve are not rather peripapillary scleral tuberculoses in the posterior ciliary vessels which end by compressing, strangling and invading the optic nerve."

Collomb's article is one which it is well worth while to read.

ERNEST THOMSON.

V.—HYDATID EXPERIMENTS IN THE EYE OF THE RABBIT

Demaria, Enrique B.—Hydatid experiments in the eye of the rabbit. (Hydatidosis experimental in el ojo del conejo.) *Arch. de Oftal. Hisb-Americanos,* August, 1919.

Demaria published a case of endocular hydatid cyst in 1916 (B.J.O., Vol. I, p. 567), with clinical and pathological details; this condition is very rare, the author's case being the second, duly proved, in the world's ophthalmic literature.

As hydatid disease in the Argentine is an affair of everyday occurrence, and as it is hardly ever found in the eye, in contrast to the cysticercus which is by no means rare there, Demaria has undertaken experimental work on the subject using the eyes of rabbits, and the result is the interesting and valuable paper to hand. It is profusely illustrated with microphotographs which show the various points very well.

The author devotes a couple of pages to the life history of the hydatid cyst, and we are pleased to see a reference to John Hunter (1793).

Records of twelve rabbits are given; the material for injection was obtained for the most part from hydatids of the liver in cows and sheep, and consisted of germinal membrane, liquid from the cyst, and dried powdered hydatid.

Case 1 (germinal membrane inserted into vitreous). This case quickly came to an untimely end, the eye being lost through panophthalmitis.

Case 2 (germinal membrane into vitreous). After a few days turbidity of the media was observed by ophthalmoscopic examination, this continued in statu quo for a month, after which time the animal was killed. The eye showed the chitinous membrane which had been inserted, still in the posterior pole of the eye, the characteristic lamination was well shown, there was

considerable inflammatory reaction in the neighbouring retina and choroid.

Case 3 and 4 (liquid and powdered hydatid injected into the anterior chamber). In this case there were no results, either clinically or histologically at the end of four months.

Cases 5 and 6. These cases were similar to the two previous ones, and there were no results.

Case 7 (injection of liquid and dried hydatid into the anterior chamber). Three months later a small hydatid developed in the cornea and one in the iris, the former being well shown in the accompanying microphotograph, with the embryo in situ.

Case 8 (vitreous inoculation with liquid and dried hydatid). After three months the eye was excised; there had been a great deal of iritis in this case, the pupil was secluded and the eye was buphthalmic, there was a cyst in the sclerotic at the site of injection, which had burrowed between the layers of the sclera, and another cyst had formed in the ciliary process. Scolices were also apparent in an oedematous fold of retina in this eye.

Case 9. Injection of liquid and dried hydatid into vitreous, with no results.

Case 10. Similar injection to that in the last case, a cataract developed. After four months the eye was excised, and the vitreous was found to be full of small cysts.

Case 11. Similar injection to last, a cataract developed and the eye was excised four months later, it showed signs of irido-cyclitis, seclusio pupillae, and a subretinal cyst which had caused a detachment.

Case 12. A similar injection to that used in Case 10, and the results were very similar.

Demaria argues with justification that the rabbit's eye is admirably adapted for the study of the development of endocular hydatid cysts; in his cases cysts developed in the cornea, iris, ciliary body, sclerotic, vitreous, and in front of and behind the retina; as they increase in size the cysts compress the neighbouring structures and lead to atrophy of the iris, choroid, etc. In the cornea and sclerotic the cysts burrow out between the layer and form very narrow, almost linear sacs, in the iris the cysts look like nodules.

Though in his cases the cysts were all young ones, Demaria has no doubt that they were fertile, and that new scolices would have been formed. The cataracts met with in the later cases might have been due to unintentional injury from the point of the needle used for the injection, or more likely from the toxic properties of the liquid injected.

R. R. JAMES.

VI.—NIGHT BLINDNESS AS A SYMPTOM OF FATIGUE

Weekers, L. — Night blindness, a symptom of fatigue. (L'héméralopie, symptôme de surmenage.) *Arch. d'Ophtal.*, July-August, 1918.

In a long and clearly-written paper, **Weekers** gives his views concerning the aetiology of the night blindness which has been so common an ailment among the troops in the recent war. He believes that this complaint is a result of *surmenage*, by which term he designates excessive fatigue, muscular or nervous, or both, induced by the conditions of active service in this war, more especially in its earlier stages. His article is one of considerable interest, and is worthy of careful perusal. It is not an easy paper to condense and would lose much of its attractiveness in an abstract.

In 1916 the author published some observations on night blindness in the Belgian Army, and since then he has had abundant opportunity for further investigation. He adduces much evidence in favour of his views, and his arguments go far to convince the reader of their soundness.

J. B. LAWFORD.

VII.—A TEST OF BINOCULAR VISION

Cantonnet, A.—A test of binocular vision based upon the experiment of the "hole in the hand." (Un test de vision binoculaire basé sur l'expérience du "trou dans la main.") *Arch. d'Ophtal.*, Nov.-Dec., 1919.

In a former paper (*Arch. d'Ophtal.*, June, 1918) **Cantonnet** recorded some experiments he had made with the " hole in the hand " visual illusion, as a test of binocular vision. In the present communication he describes and illustrates an apparatus by which greater precision is possible. This, which is readily comprehended on reference to his diagrams, consists of a rectangular strip of wood 32 cm. in length by 8 cm. in width, pierced at its midpoint by a tube 20 cm. long and 35 mm. in diameter. In this tube a fine metal wire is fixed vertically, which serves as an index. When one eye is applied to and looks through the tube the fellow eye sees a hole in the wooden strip precisely as it does in the hand in the crude experiment. The wire is also seen crossing the apparent hole.

In normal individuals the false aperture (when the accommodation is relaxed) is 6 cm. from the tube. At this point on the

wooden strip, zero is marked and by a plus and minus scale, one on each side of zero, the position in which the index wire is projected can be exactly defined and the degree of deviation of the eye, convergent or divergent, can be read off. By means of horizontal markings on the scale vertical deviations can be measured.

In principle this method is very similar to the Maddox rod-test; it is not as simple and easy to use, especially with patients of limited intelligence, and its advantages as a diagnostic measure are not obvious, Cantonnet believes that it has a real therapeutic value in cases of ill-developed and unstable fusion power, and that it provides an easy method of carrying out orthoptic exercises.

J. B. LAWFORD.

VIII.—TRAUMATIC OPHTHALMOPLEGIA EXTERNA

Velter, E. (Paris). — Traumatic bilateral ophthalmoplegia externa. (Ophtalmoplégie externe bilatérale traumatique.) *Arch. d'Ophtal.*, July-Aug., 1919.

Velter publishes clinical notes of one of the small group of cases in which ophthalmoplegia follows a blow on the head, without evidence of fracture of the skull. The patient, seen in the Ophthalmic Clinique of L'Hôtel Dieu, was shown at a meeting of the Neurological Society of Paris, where there was some discussion as to the causal lesions in this and kindred cases. The author favours the suggestion of multiple minute haemorrhages in the grey substance of the nuclei and immediately adjoining tissue. Velter's patient was a healthy man, with no pathological inheritance, free from evidence of syphilis, tubercle and lead poisoning, an abstainer and a non-smoker. He was engaged at the front, two years before, when while carrying timber for a dug-out he fell, striking his forehead violently. He was not stunned, and was able to continue his work. During the next few days he felt fatigued, suffered from headache, and noticed some swelling and ecchymosis of his right upper eyelid. Seven or eight days after the injury (the man is very definite on this point) he noticed almost complete drooping of the left upper lid and partial drooping of the right. The condition has remained unchanged since; he has never noticed diplopia. On examination there is bilateral ptosis much greater on the left than on the right side, and partially relieved by the action of the frontal muscle. Upward rotation of the globes is almost abolished. Lateral movements are much limited, and equally so on the two sides.

Rotation downwards is very restricted. Pupils are equal and circular, reacting well to light and with accommodation; the intraocular musculature is quite normal. Vision and fields normal, fundi healthy.

The man's nervous system shows no signs or symptoms of disease, except those enumerated above. Lumbar puncture reveals a normal fluid, under normal pressure. Wassermann test is negative, both for blood and cerebro-spinal fluid. Urine is free from albumen and sugar.

J. B. LAWFORD.

IX—NOSE AND THROAT INFECTIONS AS AFFECTING THE OCULAR FUNCTIONS OF AVIATORS

Berens, Major Conrad, M.C. (N. Y. City) and Uren, Capt. Claude, M.C. (Omaha, Neb.).—Effect of nose and throat infections upon ocular functions of aviators. *Amer. Jl. of Ophthal.*, March, 1920.

Berens and **Uren** base their observations upon the reports made on 38 cases seen at the Third Aviation Instruction Centre, American Expeditionary Force. These were cases which required simultaneous treatment in the Otological and Ophthalmological Departments. Of these 38 cases 19 showed ocular trouble which possibly had infection of the nose and throat as the underlying cause. The diagnoses were retro-bulbar neuritis 6 cases, convergence weakness 9, divergence excess with convergence insufficiency 1 case, acute catarrhal conjunctivitis 1, marginal blepharitis 1, and photophobia with lacrimation 1.

Attention was directed to the condition of the blind spot and vision in these cases, before and after treatment of the throat affection; also upon the state of the extrinsic and intrinsic ocular muscles. Six of the 38 cases showed definite enlargement of one or both blind spots (tested by a rapid clinical method, and compared with findings on the Bjerrum screen).

The conclusions arrived at from examination of the 38 cases went to show that enlargement of the blind spot is a frequent accompaniment of nose and throat trouble, and may be the earliest ocular symptom.

Repeated examination of the blind spot in nose and throat conditions serves as an indicator in regard to the progress of the disease, and efficacy of treatment.

The writers recommend that all aviators who are receiving treatment for focal infection should undergo routine examination of their blind spots.

Visual acuity was shown to be affected in two cases, and it is urged that aviators suffering from throat and nose infection should not be permitted to fly whilst the blind spot shows enlargement. Weakness of the extrinsic ocular muscles occurred in 10 cases, and of the intrinsic muscles in 3 cases—a proportion which should stimulate to further research. Weakness in converging power was found to be associated in many cases with a history of bad "landings."

The writers conclude by calling for intelligent research and constructive criticism on a subject which should be handled by medical men trained in aviation medicine.

J. HAMILTON MCILROY.

X.—TOURNAY'S REACTION

Chenet, L., and Noyer, A. (Rennes)—A study of the reaction of Tournay. *Arch. d'Ophtal.*, June, 1921.

In May, 1917, and again in December, 1918, Dr. A. Tournay presented to *l'Académie de Médecine* some observations on a pupillary reaction not previously recorded, viz., inequality of the pupils in lateral fixation. His papers were entitled, "The law of normal isocoria and anisocoria"; "Remarks on pupillary inequality in cases of unilateral miosis from paralysis of the sympathetic," and were published in the *Bulletin de l'Académie de Médecine*, May, 1917, and December, 1918. Little or no notice was taken of these communications until March, 1921, when a paper was read before the Ophthalmological Society of Paris by Dr. Caillaud on "Anisocoria in lateral fixation; observations on a thousand patients." This paper was supported by Drs. Coutela and Marc Landolt, who deplored the fact that "the remarkable facts observed by Dr. Tournay have not attracted more keenly the attention of oculists."

Chenet and **Noyer** have made a prolonged and detailed study of this reaction, in several thousands of individuals, of varying ages, healthy and unhealthy. As an introduction they quote from Tournay's writings, "When a man, whose ocular apparatus is normal, whose pupils are equal, reacting normally to light, contracting normally and equally with movements of convergence and accommodation, looks strongly to his right and maintains this position, the right pupil becomes larger than the left. The converse obtains when he looks to his left. Thus, isocoria being the rule in anterior fixation, anisocoria becomes the rule in lateral fixation." The "conclusions" of the writers are as follows:—

Without seeking a physiological explanation of the phenomenon noted by Tournay, and limiting ourselves strictly to facts, we consider we are able to state, as a result of our numerous examinations, that:

1. In healthy subjects, even those with ametropia, dilatation of the pupil in the abducted eye is the rule. It is not equally noticeable in all individuals, but we have never found it absent. Narrowing of the pupil of the abducted eye is infinitely less clear, and we are doubtful as to its occurrence. The pupillary inequality seems to be due to dilatation of the pupil of the eye in abduction.

2. Tournay's reaction is not found in the rabbit or the horse, but is present in the cat and the dog. It would appear, therefore, to occur in animals possessing eyes which are not in a completely lateral position, and which are endowed with free mobility.

3. Mydriatics suppress (atropin) or lessen (cocain) the reaction. Miotics (pilocarpin) abolish it.

4. In pathological cases, Tournay's reaction shows variation: (*a*) The iris being mobile, the reaction is found in all ocular affections, superficial or deep, even in those which reduce vision to perception of light (cataract), and those which destroy sight (optic atrophy). This suggests that the reaction is not a reflex, but an associated movement independent of vision; (*b*) in cases of paralysis of the sympathetic the reaction persists normally.; (*c*) this is true also of the following general diseases, syphilis, malaria, exophthalmic goitre, chronic rheumatism, pneumonia; (*d*) in lesions of the central nervous system the reaction was absent in 15 cases; they were all instances of old standing disease and include general paralysis, tabes and anterior poliomyelitis.

Particulars of the methods of examining and recording, with notes of a number of cases and some photographs, are given by the authors.

J. B. LAWFORD.

XI.—MISCELLANEOUS

(1) **Epalza.—A contribution to the clinical course and pathological anatomy of rodent ulcer of the cornea.** (**Ein Beitrag zur Klinik und pathologischen Anatomie des Ulcus Corneae rodens.**) *Klin. Monatsbl. f. Augenheilk.*, February-March, 1915, p. 266.

(1) In a case of rodent ulcer, **Epalza** noted that healing followed an intercurrent attack of diplobacillary conjunctivitis associated with a corneal perforation. This occurrence suggests that either the bacterial infection or the perforation brought about the cessation of the disease. In another case cauterization, followed by covering

with a conjunctival flap, failed and the eye was excised owing to the extreme pain. Scrapings of the surface of the ulcer yielded negative results both by culture and by inoculation. A careful account is given of the microscopical appearances. The ulcer appears to progress by a cellular infiltration of areas which subsequently break down. These infiltrated areas have not the structure of tuberculous foci, but rather that of small abscesses. Epalza believes that the condition is not a primary necrosis of the cornea, but that the cornea is destroyed by the penetration of this peculiar granulation tissue. All the appearances indicate the presence of an infection, the exact nature of which is still undetermined. The article is illustrated by two figures in the text and three plates, one of which is a fine example of colour printing.

H. M. TRAQUAIR.

(2) **Hilbert, R.—Iritis due to the action of the milky juice of Chelidonium majus L.**—*Amer. Jl. of Ophthal.*, December, 1916, from *Centralbl. f. prak. Augenheilk*, September-October, 1916.

(2) The history in the case reported by **Hilbert,** is that a man, aged 63 years, got some of the acrid milky juice of ***Chelidonium majus*** into his right eye. The result was a severe iritis with hypopyon, in addition to acute conjunctivitis. The iritis took six weeks to be cured under the usual remedies. The adhesions which had formed were broken down, but pigment remained on the lens capsule. In order to account for the uveal inflammation, the author suggests that a cauterization of the cornea took place (the juice of this plant is commonly used as a home remedy for warts), and that an entrance of the incitors of the inflammation took place through the corneal lymph channels.

ERNEST THOMSON.

(3) **Rochester, Alexander S. (Chicago).—The spontaneous explosion of Snellen improved artificial eyes.** *Ophthal. Record*, December, 1916.

(3) **Rochester** reviews the recorded cases of spontaneous explosion of Snellen improved artificial eyes. It would appear that quite a number of these eyes explode in the manufacturer's stores before they are sent out. The cause of the collapse of the thin walls is due to the fact that the glass is imperfectly annealed and encloses a partial vacuum of rather high degree and any sudden change of temperature is apt to produce unequal expansion or contraction of the glass which is unequal in thickness and which is then less able to withstand the continuous atmospheric pressure. He has found that most of the explosions have happened during either very hot or very cold weather.

Another factor is the destructive effect of the orbital discharge of

certain patients. It is recognized that some patients find their artificial eyes deteriorate from discolouration and erosion much more quickly than others, and Rochester has discovered that out of eighteen explosions reported, four patients had experienced the accident on two separate occasions, *i.e.*, 28 per cent. had experienced a repetition of the phenomenon.

J. JAMESON EVANS.

(4) **Smith, E. Temple (Sydney).—Notes on some cases of metastatic meningococcal infection of the eye.** *Medical Journ. of Australia*, February 3, 1917.

(4) Some few years ago (1911) it was pointed out by the late George Coats and J. Graham Forbes that in children the meningococcus may cause uveitis (pseudo-glioma) without associated symptoms of meningitis. In four such cases they recovered an organism believed to be the meningococcus from the inflamed eye.

During the course of a few months **Smith** has met with five cases of metastatic uveitis in children under two years of age. In four of these cases there were symptoms of cerebro-spinal meningitis, but in the fifth such were absent. This case was believed to belong to the Coats-Forbes's group. A few details may be given. Child admitted on the seventh day of an illness characterised by feverishness and pains in the stomach. On the fourth day one eye was inflamed and the lids were oedematous. The eye had a mucopurulent discharge, the conjunctiva was injected, the aqueous was cloudy, and there was hypopyon. Pneumococci were obtained from a conjunctival smear. The child recovered, and the affected eye had so much the appearance of glioma that it was enucleated by another ophthalmic surgeon. Pathological examination of the excised eye, however, showed that there was no evidence of a neoplasm, and that the appearances were such as would follow an inflammatory condition of the uvea, accompanied by detachment of the retina.

S. S.

(5) **Hirsch, G. (Halberstadt).—Epithelial implantation tumour of the iris. (Epithelialer Transplantationstumor der iris.)** *Klin. Monatsbl. f. Augenheilk.*, February-March, 1917.

(5) **Hirsch** records a case of an implantation tumour of the iris in a girl of 18. She said that the eye had been red for some weeks and that two days before consulting him something had got into it. On examination, there was seen in the upper and inner quadrant of the iris a yellowish-white sausage-shaped tumour whose base seemed to lie in one of the lacunae of the ciliary portion of that structure. It was small, but, on account of its contrast in colour with the dark brown iris, very conspicuous. The eye was injected, specially in

the neighbourhood of the growth. The pupil dilated only to a slight extent with atropin. The growth was removed by an iridectomy. The specimen was sent to the Zoological Institute on the supposition that it was a cysticercus. The microscopical examination showed that this was not the case. The tumour consisted of an unpigmented solid mass of epithelial cells. Since the tumour had broken through from the posterior to the anterior layers of the iris it seemed reasonable to assume that it was of a malignant nature, but, in opposition to this, the cells were not of a malignant type, nor were they accompanied by any vessels or interstitial stroma. It is true that no wound of entrance could be made out, but this may well have been microscopic. Hirsch concludes that it must have been an implantation tumour. There was no recurrence and the eye remained free from inflammation.

E. E. H.

(6) **Gifford, H. (Omaha). — On the frequency of occlusion of the inner end of canaliculus in old trachoma.** *Ophthal. Record*, September, 1917.

(6) **Gifford** states that in old trachoma with much atrophy, occlusion of the inner ends of the canaliculi is so frequent as to be almost constant. It should be searched for systematically as a source of recurrent keratitis or of possible infection where a cataract operation is proposed. The canalicular suppuration ceases when the canaliculi have been slit up and kept open so as to unite the upper and lower ones, and a zinc collyrium used together with any other treatment which the trachoma or suppuration of the Meibomian glands may require.

J. JAMESON EVANS.

(7) **Scherzer, I. (Graz) — Contribution to the recorded cases of small shot injury of the eye. (Beitrag zur Kasuistik der Schrotschlussverletzung des Auges.)** *Klin. Monatsbl. f. Augenheilk.*, September-October, 1917.

(7) **Scherzer's** case was that of a child aged 14 whose right eye was penetrated by a shot 1·25 mm. in diameter. The shot was fired from a distance of about 15 metres, and there were 40 to 50 pellets under the skin of the face. The wound of entry in the eye was about 2 mm. from the limbus at the nasal end of the horizontal meridian. Large membranous vitreous opacities were seen, and to the nasal side of the disc, at about the same distance as the macula, a triangular glistening patch surrounded by blood clot was to be made out. 40° to the temporal side of the fovea there was a second oval white spot limited by blood clot. Still further to the temporal side from this second patch, at the extreme limit of the ophthalmoscopic

field, there was a round grey, glistening foreign body. V. was 0·6. There was a scotoma in the upper temporal field which reached to the blind spot.

The shot was removed by Salzmann through the sclerotic, after temporary separation of the external rectus. The removal was done with iris forceps with the aid of transillumination from a Sachs lamp at the inner canthus. Much vitreous was lost. A month later vision was practically normal.

The ophthalmoscopic picture seen above is explained as being caused by the shot rebounding twice before reaching its final position.

The rest of the paper is taken up with the discussion of previously recorded cases and the various opinions of German authorities as to the prognosis of lead particles in the eye.

E. E. H.

(8) **Cousin, G.—A rapid method of obtaining a cast of the orbital cavity.** (**Un procédé rapide de moulage de la cavité orbitaire.**) *Arch. d'Ophtal.*, Sept.-Oct., 1917.

(8) **Cousin** records his experience, at the Ninth Ophthalmic Centre of the French Army, of the various materials in use for making casts of the cavity of the orbit after removal of the eyeball, especially in cases in which cicatricial bands have led to diminution in size or to deformity of the cavity. He strongly recommends the employment of a material known in commerce as "pastelline," and used in the studio by sculptors. It is a paste with a fatty base, and the heat of the hands, after a few minutes' manipulation, gives it the consistence of putty. It is easily inserted into the cocainised conjunctiva, and trimmed off with a small metal or wooden spatula until the lids can be easily opened and closed over it. The mass should be left *in situ* for about half an hour, and then removed and allowed to harden, which it does in a few moments. The cast is then ready for use as a model for the prothesis.

J. B. LAWFORD.

(9) **Dundas, Grace H. Giffen (Middlesborough).—Illegitimate births and ophthalmia neonatorum.** *Brit. Med Jl.*, March 27, 1920.

(9) That ophthalmia neonatorum is commoner in illegitimate than legitimate births is no new observation. The figures of Timgren, Widmark, Hein, and others are conclusive on that point. **Dundas** looks into the question from a statistical point of view. Ophthalmia neonatorum, she reminds us, has been notifiable since April, 1914, and she quotes the figures for the six

years inclusive, 1914 to 1919, of four large boroughs—one in Scotland, one in the north of England, and two in the south of England; the averages of the first three years and of the second three years are given. In all four boroughs there was an increase in the number of illegitimate births. In the first and second boroughs the increase in cases of notified ophthalmia neonatorum was very marked, while in the third and fourth boroughs, although there was an actual increase in the number of cases, the proportion of cases to the number of illegitimate births was not raised in comparison with the first three years.

S. S.

COUNCIL OF BRITISH OPHTHALMOLOGISTS

A Report on some Public Authorities who are in the habit of referring Ophthalmic Cases to Hospitals for Examination, Treatment, and (or) Report.—*Continued from page* 468.

Police Force of Great Britain

The Police Forces of Great Britain, though to some extent regulated by the Home Office, are, in fact, controlled by the local authorities of the several districts and have no uniform standard of medical service.

With reference to ophthalmic treatment the Council found examples of the following different methods of procedure:—

1. In addition to a police surgeon there is a salaried ophthalmic surgeon to whom eye cases can be referred. This is the method in Leeds.

2. The police surgeon can, if necessary, refer any particular case for a special opinion to an ophthalmic surgeon, but there is no official ophthalmic surgeon. This is the method adopted in the following places:—City of London, Manchester, Wolverhampton, Oxford, Nottingham, and Exeter. In some instances the authority of the Watch Committee has to be obtained before a case can be referred to an ophthalmic surgeon.

3. The police contributes to a hospital directly as in the case of Edinburgh (1d. a week to the Royal Infirmary); or the Watch Committee, as in the case of Birmingham, gives an annual subscription to the hospital at which the cases are treated.

4. Cases are sent to hospitals, but no contributions are made towards the hospital funds. Such conditions obtain at Bristol and in some parts of the metropolitan area.

5. In some instances a combination of schemes 2, 3, and 4 obtain. Thus the Metropolitan Police, though providing for medical attendance, usually send their eye cases to hospitals, but in rare instances to an ophthalmic surgeon and pay a fee for his services.

6. There is a police surgeon but no special provision for ophthalmic examination. This is the case in Essex.

The Council has found it impracticable to investigate the conditions obtaining in all the police forces of the United Kingdom, but the above may be taken as characteristic examples.

The Council is of opinion that the medical service of the police force cannot be adequate unless it includes the services of ophthalmic surgeons to whom officers and recruits can be referred for expert opinion and report.

In further pursuance of the matters dealt with in the first part of this report, the following communication has been sent to the Postmaster-General.

To the Postmaster General.

SIR,

The Council of British Ophthalmologists have had their attention drawn to the large number of Post Office employés sent by your medical officers to the hospital for ophthalmic advice, treatment or report.

For example, the numbers of your employés who attended at the three following hospitals during the year 1920, are: Royal London Ophthalmic Hospital, 180 (approximate); Royal Westminster Ophthalmic Hospital, 136; Central London Ophthalmic Hospital, 282.

The Council understand that the Post Office undertakes to provide medical treatment for its employés under certain wage limit with the object of ensuring their efficiency for the performance of their duties.

The Council note that no ophthalmic surgeons are appointed to whom the Post Office Medical Officer can refer eye cases. They further consider that the efficiency of the service cannot be maintained without such assistance.

The Council feel that medical reports on which presumably official action may be taken, should, in justice to all concerned, be given only by those officially appointed by the Post Office authorities for that purpose.

After due consideration, the Council desired me to forward you the following resolution that "The Postal Medical service cannot be adequate unless it includes the services of ophthalmic surgeons to whom recruits and employés could be referred for expert opinion and report."

NOTES

Death

WE regret to announce the death on September 30, from double pneumonia of septic origin, at Audlem, Cheshire, of Lieut.-Colonel F. P. Maynard, I.M.S. (retd.), at the age of 57 years. He was interred in Audlem Parish Church, the service being conducted by the Rev. Canon Stapleton Cotton. He leaves a widow, a son, and a daughter to lament his loss. Since his retirement from the Indian Medical Service about a year ago, he has lived at Audlem, practising as an ophthalmic surgeon in Crewe, and holding an appointment as oculist to the Cheshire County Council Schools. He was the son of Thomas Maynard, and was born at Preston, Lancs., and was educated at the local grammar school. He received his medical education at St. Bartholomew's Hospital, London, Paris, Bonn, and Würzburg. He entered the I.M.S. at the age of 23 from Netley, passing out third on the list. In India Maynard had a distinguished career. He was at first attached to Allahabad Station Hospital, and from thence was transferred to cholera duty at Kohat. He was then given medical charge of the 27th Punjab Infantry at Bareilly, also of the 2/3 Gurkhas at Kaludanda. At a later period he was placed in medical charge at Dinapore, of the 13th Brigade of Infantry. He was professor of ophthalmic surgery at the Medical College at Calcutta, and ophthalmic surgeon to the Medical College Hospital and surgical superintendent of the Mayo Hospital, Calcutta. He also edited for many years the *Indian Medical Gazette*. Despite poor health, he found energy to write several books, as well as many medical publications. His best known book was "A Manual of Ophthalmic Operations," (1908), which was followed by a second edition in 1920. The keynotes of Maynard's character were great sympathy with the sick and suffering poor, and simplicity in everything he undertook. His energy is shown by the fact that quite recently he visited Barcelona in order to witness Barraquer remove cataract by his operation of suction (phacoerisis), and provided himself with all the instruments necessary for its performance which he did not live to accomplish.

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Appointment

WALTER H. KIEP has been appointed professor of ophthalmology in the Cairo Medical College, with charge of the ophthalmological clinic at Kasr-el-Ainy Hospital.